REMARKS

Claims 1-14, as to be amended by request, still remains in this application.

Because of the differences of opinion as to the relevancy and meaning of the 1st and 2nd laws of thermodynamics as they apply to this invention between the Examiner and Applicants, a declaration by a co-inventor, Thomas E. Bearden is included herein to refute the Examiner's contention and support the proposition that the invention is in compliance with 35 U.S.C. § 101 and is patentable.

It is requested that the requirement that the Applicants provide a demonstration be held in abeyance until after the Examiner has studied this amendment and Declaration.

Reconsideration of the rejection of all the claims as not being in compliance with 35 U.S.C. § 101 is respectfully requested. On page 3 the Examiner: states that "...to generate electricity by exploiting static energy from the magnetic flux of the permanent magnet and by the motionless generator's nature of being an open dissipative system, receiving, collecting, and dissipating energy from its environment, i.e., from the magnetic flux stored within the permanent magnet."

Response: The permanent magnet is a dipole, i.e., it consists of two opposite magnetic charges called "poles". According to the Nobel Prize granted to Lee and Yang in 1957, opposite charges—i.e., any dipolarity—constitutes a broken symmetry in the virtual particle flux of vacuum.

By the definition of broken symmetry, this means that the magnetic dipole continuously absorbs virtual EM energy from the vacuum, transduces it into observable EM energy, and re-emits the energy as *observable photons*, radiating in all directions at light speed. A dipole is thus a nonequilibrium steady state flow of energy extracted from the vacuum.

The "static" magnetic field in space surrounding the magnet, e.g., is comprised of photons—*else quantum mechanics, quantum electrodynamics, and quantum field theory must be discarded.* Any photon in space is moving at light speed, *a priori*. So the "static" field of a permanent magnet is rigorously a *nonequilibrium steady state continuous emission of photons from the magnetic dipole*. This problem—the steady emission of real observable photons by energy source charge or dipole, without any corresponding *observable* input of energy—has long been known {82},{83}. But it has been scrubbed out of classical electrodynamics (CED) texts and electrical engineering (EE) texts.

As does any dipolarity, the magnetic dipole exhibits the asymmetry of opposite charges {48},{49},{57},{60},{84},{85}. Hence the permanent magnet dipole continuously absorbs virtual energy from the seething vacuum, but has an asymmetry in that exchange. This asymmetry means that the dipole *does not* re-radiate all the absorbed energy back in virtual state form, and as virtual photons. Instead, *some of the absorbed energy is coherently integrated and re-emitted as real, observable photons—moving outward at light speed in all directions.*

The magnetic dipole thus is a classical example of Prigogine's "dissipative structures", for which he received the Nobel Prize in 1977. The static field of the magnet *is not* an "equilibrium

structure" as standard classical EM and electrical engineering consider it. In fact it is a dissipative structure of the kind pioneered by Nobelist Prigogine in his thermodynamics of dissipative structures. Quoting Prigogine {[1]}:

> *"This leads precisely to a distinction between 'equilibrium structures' which may be understood in terms of classical equilibrium thermodynamics and 'dissipative structures'. The latter are formed and maintained through the exchange of energy and matter in non-equilibrium conditions."*

As a dissipative structure, the "static field" of a dipolarity must be considered in the sense given by Van Flandern {80}. Consider a flawless waterfall: A truly "static" waterfall would be a frozen waterfall, whose internal parts (the molecules of water) are not in motion at all. On the other hand, if the internal parts (the water molecules) are in constant motion, as in an unfrozen waterfall, the waterfall still appears "static" to the external observer. However, it is actually a "steady state flow" with all its internal parts (the molecules of water) in constant motion. Each moves away and is constantly replaced by those coming behind it. In fact, the waterfall is a dissipative structure in a nonequilibrium steady state system. The "static" waterfall's internal parts (in this case, photons) are in constant movement at the speed of light, being continuously replaced by the follow-on moving internal components (follow-on photons).

Thus the unfrozen waterfall (i.e., the external magnetic field from the permanent magnet) appears "static", but the field is actually a nonequilibrium steady state flow of real, observable photons moving at light speed. For a rigorous *wave-type* proof that any EM field or potential decomposes into a set of internal EM energy flows, see Whittaker {77},{78}.

So the "static" magnetic field of a permanent magnet is a nonequilibrium steady state flow of energy, with its constituent photons moving outward at light speed and continually being replaced by those emitted behind them. *The result is a steady field intensity maintained at each and every point in space occupied by this steady state flow.*

It is true that, at any moment, a certain amount of magnetic field energy is "stored" in the magnet. However, the energy (in the form of observable photons) is constantly leaving at a steady rate. But the departing photon energy is also being constantly replaced by absorbed virtual photon energy transformed into observable energy at that same rate. Consequently, real EM energy continually pours from the magnet into space, but it is continually replaced by absorbed and transduced energy from the seething vacuum.

Any such steady state energy flow involves a dissipative structure a la Prigogine. Rigorously, energy can in theory be collected freely from the flow and used to power loads, with one paying only for the switching and controlling *and not for the energy flow itself*, which is freely furnished by the "river".

If the "static field" energy of a permanent magnet is properly understood as a steady state EM energy flow of real photons—i.e., as a Prigogine nonequilibrium steady state flow and therefore a dissipative structure—then physical operations and mechanisms are possible which collect excess energy from said steady state flow and use it to power external loads. *It is then up to the inventor to discover one or more operations and mechanisms for collecting energy from that steady energy flow (from the "energy river") in a practical and usable manner.*

Between the ends of a dipole, there exists a potential (potential difference). But *any* EM potential or field rigorously decomposes into bidirectional EM energy flows as shown in 1903 and 1904 by

Whittaker {77},{78}. Thus the permanent magnet has been known to be a flow of energy since the early 1900s. There is a real meaning to a field line originating on one pole flowing into space, and returning into the other pole. Looking merely at the dipole, immediately one sees the outgoing and incoming bidirectional energy flows rigorously shown by Whittaker.
Given such a free and continuous flow of energy, it follows that one can continually collect energy from the flow, and need not destroy the magnet or the magnetic dipole—or the continuous energy flow—to do so. Again, it is up to the individual inventor to discover processes for doing so.
In the case of the MEG, evoking the Aharonov-Bohm effect {27},{28} provides a gauge transformation of the surrounding space {32} outside the core region (outside the region where the **B**-flux is localized). This rigorously results in *excess energy* appearing in the surrounding external space, in the form of an uncurled **A**-potential.
Perturbing the input signals to the MEG's input coil perturbs the localized **B**-flux in the MEG core. It also freely perturbs the curl-free **A**-potential in the gauge-transformed exterior space, Since the input signals to the MEG are pulses, with sharp rise times and sharp decay times, the sharp gradients in the freely perturbed **A**-potential region produce strong **E**-field energy pulses, by the well-known equation $d\mathbf{A}/dt = -\mathbf{E}$.
The MEG does receive free excess energy from its gauge transformed outer space environment, and the resulting strong **E**-field energy pulses are directly input to every coil on the MEG core. Hence the MEG is in fact utilizing a known and legitimate effect that guarantees the receipt of extra collected energy in the MEG. The MEG thus produces COP > 1.0 while maintaining an overall efficiency ξ of $\xi < 100\%$, analogous to a common heat pump's operation. The MEG also obeys the laws of physics and of nonequilibrium thermodynamics.

The following is in response to the Examiner's comment as quoted "... operates with a coefficient of over 3."
Response: Many things operate with a coefficient over 3. For example, a heat pump, a windmill, a waterwheel, a sailboat, a solar array powered electrical power distribution system, and a hydroelectric power system including its transmission lines and all its distant loads. The heat pump exhibits COP = 3.0 to 4.0, with a theoretical maximum {26} of about COP = 9.22. All the other cited examples exhibit COP = ∞. All the cited examples still exhibit overall *efficiency* ξ of $\xi < 100\%$.The MEG is a nonequilibrium system, freely receiving excess energy from its active **A**-potential environment, precisely analogous to a home heat pump (which receives excess energy from its atmospheric environment).
Further, as previously stated, any dipole (such as a permanent magnet) freely produces a steady state set of EM energy flows, freely and continuously extracted from the seething vacuum.
In particle physics (but not in the hoary old classical electrical engineering model), the magnetic dipole—as is any dipolarity—is known to be an *asymmetry in the virtual photon flux of the modern quantum mechanical vacuum*. Quoting Nobelist Lee {[2]}:

> *"... the discoveries made in 1957 established not only right-left asymmetry, but also the asymmetry of the positive and negative signs of electric charge.*

One points out trivially that all magnetism may be considered to come from the spin of electric charge. Hence a broken symmetry of opposite electric charges also involves a broken symmetry

of opposite magnetic charges which are just opposite magnetic poles (and therefore a magnetic dipolarity). Or, one recognizes that electric and magnetic field are just different aspects of the same thing, seen in different observer frames. E.g., Jackson {[3]} states it as:

> *"...**E** and **B** have no independent existence. A purely electric or magnetic field in one coordinate system will appear as a mixture of electric and magnetic fields in another coordinate frame. ... Of course certain restrictions apply ... so that, for example, a purely electrostatic field in one coordinate system cannot be transformed into a purely magnetostatic field in another. But the fields are completely interrelated, and one should properly speak of the electromagnetic field $F^{\alpha\beta}$, rather than **E** or **B** separately."*

The entire magnetic dipole system of the permanent magnet, complete with input and output—consisting of (i) the steady virtual particle photon absorption from the vacuum as its input, (ii) the dipole itself, and (iii) the observable steady *observable* photon emission as its output—rigorously is a *nonequilibrium steady state system*. As such, it is not in equilibrium with its environment (the active vacuum), but is in steady state disequilibrium therein due to the proven broken symmetry of opposite charges {48},{49}. Further, its broken symmetry requires that it *transduce* some of its received virtual state energy into real observable energy, and re-emit the energy in that *observable form*. Lee said it very simply {[4]}:

> *"Since non-observables imply symmetry, these discoveries of asymmetry must imply observables."*

As stated previously in our background section, this is an example of the permissible production of *negative entropy*, of the fashion shown theoretically possible by Evans and Rondoni {46}, and rigorously permitted by Leyton's new object-oriented geometry and hierarchies of symmetry {45}.

For a deep thermodynamic consideration of the "static" field of the permanent magnet, the thermodynamics of nonequilibrium steady state (NESS) systems applies rather than classical equilibrium thermodynamics. A *NESS* system is permitted to exhibit COP > 1.0, even though its efficiency is less than 100%. E.g., a common home heat pump in steady operation may have an efficiency of 50%, but it will have a normal COP of COP = 3.0 to 4.0 in actual practice. Its theoretical maximum COP is COP ≈ 9.22, according to standard university physics texts such as that by Halliday and Resnick {26}.

Accordingly, the examiner's objection to the permissibility of COP = 3 is invalid, because the MEG is a nonequilibrium system and thus permitted to exhibit COP > 1.0 since it also freely receives excess energy from its active environment. Again, thermodynamically the MEG operates exactly analogous to a standard home heat pump. And like the heat pump, the MEG obeys the laws of physics and thermodynamics, while permissibly exhibiting COP > 1.0.

This is in reponse to the Examiner's statement that "...generates the power required to drive the input coils (26 and 28) all within the right output coil (29) thus allowing additional loads."

Response: Given a system COP > 1.0 (e.g., take COP = 5.0), any such system can in theory "power itself" by shuttling a part of its output energy to its own input section, and clamping and governing it. The COP > 5.0 system is a nonequilibrium system *a priori*, freely

receiving excess energy from its active environment. So it legitimately outputs more energy (nominally by a factor of five) than the amount of primary external power source energy that the operator must input and pay for.

Let us consider that, in "open loop" operation, the operator puts in one part of energy, and the system thus outputs 5 parts of energy. Suppose a 50% efficient process for clamped positive feedback (of some of the output energy, back to the input section) is available in the known state of the art. Then two parts of the MEG's energy output may be fed back by the 50% "feedback subsystem" to the input section, with proper phasing etc. also arranged, to freely furnish that one part of energy normally furnished by the operator and paid for by him.

At that point, the MEG output feedback subsystem is freely furnishing the MEG's input energy requirement. The MEG output section is still putting out *three* of those original five parts of energy as usable output to power its external loads. It continuously furnishes to the operator's input section (via the clamped positive feedback after its 50% losses) the one part of energy input needed by the MEG.

At that point, the conventional external generator or other power supply is supplying no energy input to the system, because all the input energy is being furnished freely from the clamped feedback subsystem. So the conventional generator power supply or other external power supply *can just be disconnected*, and the MEG unit will continue to power itself (with the energy it is receiving from its seething vacuum exchange) while simultaneously powering its loads.

This is nothing new! *This manner of operation of a self-powering generator system—called a "negative resistor" because it received input energy from the vacuum as contrasted to only dissipating energy back to it—was detailed decades ago by the great Gabriel Kron* {109}. The overall MEG system in this "self-powering" or "negative resistor" mode—i.e., in its COP = ∞ mode—now outputs less overall energy for load powering than it did as an "open loop" system with operator input. But it also no longer requires the operator himself to input any energy from a conventional external power supply. Hence the actual COP (defined as *useful energy output* divided by *only the operator's energy input*) is $COP = 3 \div 0 = \infty$. All the required five parts of input energy come from the active external vacuum environment and the MEG's broken symmetry in it, with the operator having to input nothing at all.

Thermodynamically, a windmill, waterwheel, sailboat, and a solar array powered electrical power system are all examples of COP = ∞ systems. They are all nonequilibrium systems freely receiving energy from their active external environment.

For such a nonequilibrium system, all that is required for such "self-powering" of the load and the system itself, is that (i) sufficient energy be input freely by the active environment, (ii) part of the energy is used to power the system and its losses, and (iii) the remainder of the energy is used to power the load.

In fact, that is *really* what one does when one connects the external power supply: The operator supplies input energy from the "energetic external environment" (in this case, said external power supply portion of that external environment) via special means that the operator has to pay for. The environment does not *freely* furnish the input energy, and so the operator has to pay to *force* it to furnish the energy. On the other hand, when the environment *freely* furnishes all the energy input required, the operator need pay for nothing because no other conventional energy input is necessary.

Again, well-known examples of other systems exhibiting precisely such self-powering $COP = \infty$ operation are (i) the windmill-driven electrical power system, (ii) the hydroelectric power system, and (iii) a solar cell array power system. All those systems have efficiencies less than 100% (a common solar cell's efficiency is about 17% nominally), but they take all their required input energy input directly from their active environment.

The MEG evokes the Aharonov-Bohm effect {27},{28}to localize the **B**-field flux inside the core, thereby producing an extra field-free **A**-potential in space immediately outside said core. That **A**-potential is the result of a gauge transformation {32}. It also represents a dipolar region, since any potential is actually a *potential difference* (between two other potentials represented by the ends of a dipolarity)—e.g., between the differing potentials of differing charges.

The MEG uses the proven broken symmetry of a dipole to deliberately receive additional EM energy freely from its external active environment (the asymmetric local vacuum). With sufficient output (say, with open system COP = 5.0), use of clamped and governed positive feedback will allow the MEG system to use part of that energy from the vacuum to power itself as well as its load. Such a system is often informally referred to as a "closed loop" system or a "self-powering" system.

No law of physics or thermodynamics is violated or infringed by close-looping for self-operation and COP = ∞. In fact, nonequilibrium systems can permissibly demonstrate five "unusual" functions. Such a system {[5]} can

1. self-order,
2. self-oscillate or self-rotate,
3. output more energy than the operator inputs and thus exhibit COP >1.0 (the excess energy is freely received from the active environment),
4. power itself and its loads (exhibit COP = ∞ via means such as clamped positive feedback; all the energy—required to power the load and power the system losses simultaneously—is freely received from the active external environment), and
5. exhibit negative entropy (closely associated with item (i). We stress that this is not true at all for conventional equilibrium systems! It is true, however, for nonequilibrium systems.

On page 3 the Examiner states that the first law of thermodynamics (conservation of energy) cannot be evaded.

Response: Highly simplified statement, but okay for most practical work with *equilibrium* systems. It has nothing at all to do with *nonequilibrium* systems such as the common heat pump—permissibly producing COP > 1.0 even though their efficiency ξ is $\xi < 100\%$—and such as the MEG, continually receiving excess bursts of **E**-field energy freely input into the MEG system from the gauge-transformed space with freely generated **A**-potential, outside the MEG core. Such COP > 1.0 nonequilibrium systems do not violate the first law (energy conservation). The excess energy for the additional output is freely furnished from the active environment—as in the case of the common home heat pump.

The examiner should also recognize that statement of the conservation of energy itself can

vary. The most general statement is that *energy can neither be created nor destroyed*. That statement is always valid. The usual statement in other forms is in fact only an approximation—usually a sufficiently good one. E.g., almost always one assumes that the system thermodynamics situation is *local*; i.e., that the general relativity of the situation can be closely approximated by assuming that the system locally exists in its own little *special relativity zone* without spacetime curvature. As Kondepudi and Prigogine {[6]} point out:

"One general point to note about the First Law and the Second Law is that both laws must be local laws. In fact, to be compatible with the principle of relativity, and to be valid regardless of the observer's state of motion, these laws must be local. Nonlocal laws of energy conservation or of entropy production are inadmissible because the notion of simultaneity is relative. Consider two parts of a system spatially separated by some nonzero distance. If changes in energy δu_1 and δu_2 occur in these two parts simultaneously in one frame of reference so that $\delta u_1 + \delta u_2 = 0$, the energy is conserved. However, in another frame of reference that is in motion with respect to the first, the two changes in energy will not occur simultaneously. Thus, during the time between one change of u and the other, the law of conservation of energy will be violated. Similarly, the entropy changes in a system, δS_1 and δS_2 at two spatially separated parts of a system must be independently positive. It is inadmissible to have the simultaneous decrease of one and increase of the other so that their sum is positive."

Also, nonequilibrium systems can and do involve *nonlocal effects*, in spite of the local statements of the laws of equilibrium thermodynamics. Again, quoting Kondepudi and Prigogine {[7]}:

"One aspect is common to all these nonequilibrium situations, the appearance of long-range coherence. Macroscopically distinct parts become correlated. This is in contrast to equilibrium situations where the range of correlations is determined by short-range molecular forces. As a result, situations which are impossible to realize at equilibrium become possible in far-from-equilibrium situations. This leads to important applications in a variety of fields.

Classical Maxwellian electrodynamics is also naturally *special* relativistic, not *general* relativistic. One never accounts for all the energy, *but only for the energy changes* {66}.

Immediately after the advent of general relativity, the fact that it destroys our usual notion of the local conservation of energy law, was noted by the great Hilbert in 1917 as follows {[8]}:

"I assert... that for the general theory of relativity, i.e., in the case of general invariance of the Hamiltonian function, energy equations... corresponding to the energy equations in orthogonally invariant theories do not exist at all. I could even take this circumstance as the characteristic feature of the general theory of relativity."

Other physicists have also pointed out this startling aspect of general relativity. E.g., Logunov and Loskutov state {[9]}:

"In formulating the equivalence principle, Einstein actually abandoned the idea of the gravitational field as a Faraday-Maxwell field, and this is reflected in the pseudotensorial characterization of the gravitational field that he introduced. Hilbert was the first to draw attention to the consequences of this. ... Unfortunately, ... Hilbert was evidently not understood by his contemporaries, since neither Einstein himself nor

other physicists recognized the fact that in general relativity conservation laws for energy, momentum, and angular momentum are in principle impossible."

Thermodynamicists avoid these startling consequences of general relativity by only considering systems obeying special relativity with local laws and local thermodynamics. Kondepudi and Prigogine point out {[10]}:

"Nonlocal laws of energy conservation or entropy production are inadmissible because the notion of simultaneity is relative."

In fact, a given object observed in one frame will have a given energy W; and when observed in a different frame it may have a quite different energy $W + \Delta W$. This further illustrates that we never specify or account the actual *total energy* of a situation. Instead, we can only account the *changes* in the energy, as observed in a selected inertial frame.

When the frame is noninertial, as in a general relativity accelerated frame, then part of the usually "constant energy" of the background energy (such as the active vacuum and spacetime distortion) can become part of the energy change. In that case, the external observer in his inertial frame "sees" an apparent violation of energy conservation, because during the observation the assumption of "one joule of energy change at time one is one joule of energy change at time two" is violated. In simple terms, that is the thermodynamic gist of the impact of general relativity on conventional energy conservation laws, as pointed out early-on by Hilbert {63} and later by scientists such as Logunov and Loskutov {64}.

Some engineers take a rather mundane approach to this strange general relativistic property of nature, where even the first law of classical thermodynamics can be violated because of global intervention. The First Law as conventionally written assumes local special relativity only, with the absence of any significant general relativity effects. For most practical systems, we may simply accept and use the local special relativistic approximation, which usually holds sufficiently well for electrical power engineering.

It should be obvious, however, that during strong gradients, accelerations may prevail and the assumption of special relativity—an unaccelerated frame—can readily be violated.

But regardless of the assumptions and calculations, *we are never accounting for all the energy that is present and active*. Rigorously, in science only *changes* in energy can be observed or theoretically accounted, and the constant background energy remaining and not participating cannot be ascertained. Kondepudi and Prigogine state it as {[11]}:

"Thermodynamically, energy is only defined up to an additive constant. In physical processes, it is only the change in energy... that can be measured and there is no way to measure the absolute value of energy."

There are some unexpected aspects of the very definition of "energy" when we are speaking of "observed energy" in a change. There is always much more energy available that *did not change* in an inertial frame—but that can be engaged in a momentarily *accelerated* frame. The primary example is the incredibly dense background energy of the modern vacuum in which the system is embedded. So only the *changes* in energy are accounted thermodynamically in the application of the first law.

As an example, a single electron—according to modern physics—actually is associated with two background infinite charges of opposite sign, and thus with two infinite background energies involved {42}. One only "sees" and measures the finite difference between these two infinite

charges. *Nonetheless, the infinite energies are there.*

Perhaps unknown to the examiner, his own flawed Maxwell-Heaviside classical electrodynamics (CED) and electrical engineering (EE) model in fact assumes that every EM field, EM potential, and every joule of EM energy in the universe is and has been freely created out of nothing at all, by the associated source charge. That assumption, of course, is a total violation of the first law of thermodynamics in its most general form. *The CED and EE models cannot be used to analyze the performance of any EM power system taking excess energy from its active vacuum environment.*

The solution to this "source charge problem" is that the *global* environment—the virtual particle energy flux of the seething vacuum—provides the energy input to the source charge, in a form not modeled or accounted in electrical engineering (nor in classical thermodynamics).

So, since electrical engineering does not model the active vacuum, it does not model the actual virtual state energy input to every source charge in the universe, making possible the formation of all EM fields and potentials and the emergence of every joule of observable EM energy.

One typically assumes ubiquitous violation of the first law of thermodynamics by every charge, dipole, EM field, EM potential, and joule of EM energy in the universe.

All COP > 1.0 EM systems taking their energy from the vacuum also output a mix of both *positive* energy and *negative* energy.

Positive energy is basically divergent energy. Flowing in circuits, it always tries to diverge from its propagation path back to the external environment.

Conductivity is that characteristic of the conductor which holds the energy flow unchanged along its propagation path.

Negative energy is basically convergent energy. When negative energy is flowing in circuits, additional convergent energy (negative energy) from the environment is continually trying to enter the circuit and increase the negative energy flowing along its path. Again, conductivity prevents this change from happening, and maintains the flow of negative energy unchanged.

Impedance is that characteristic of the circuit path that reduces conductivity by opening the energy flow propagation path to an energy exchange with its external environment.

For positive energy flow, the impedances (resistive, capacitive, and inductive) in a circuit result in positive energy flow *losses*. In each impedance component, some of the flowing positive energy diverges from the path and escapes back into the environment. Such positive energy circuits obviously output less energy than is input, because some of the input energy flow escapes before reaching the output.

For negative energy flow, the impedances (resistive, capacitive, and inductive) reduce the ability of the conductor to *hold back* the excess convergent negative energy attempting to press in from the external environment. Hence, any impedance in the circuit along the negative energy flow path results in excess negative energy flow being added to the input flow. Every impedance results in negative energy flow *gain*. It therefore *increases* the amount of negative energy flowing in the propagation path.

The deliberate use of negative energy in circuits has a truly strange and marvelous effect. *All the impedances of the circuit act as energy amplifiers, freely causing excess negative energy from the environment to freely enter the negative energy flow and increase its magnitude.*

Dirac Sea holes have negative mass, and as source charges they produce negative energy fields. The

implications of negative energy and negative energy flow are profound. E.g., quoting Hoffman {[12]}:

"... extremely powerful energy sources may occur if particles of negative mass really exist in nature."

Dirac Sea holes have negative mass so long as they remain holes and have not interacted with lattice mass. So Hoffman is correct. Eventually, special circuits—using Dirac Sea hole currents that persist for a short time—will be developed as extremely powerful EM energy sources. These will eventually replace most positive energy generators, centralized power distribution grids, and huge centralized power systems, while filling most of the world's electrical energy needs.

This negative energy effect does not yet appear in electrical power engineering texts, but it is a legitimate experimental effect uncovered by various COP > 1.0 energy researchers and experimentally proven by them. From what has already been uncovered, e.g. by Bedini [13], negative energy currents that persist for a bit in a circuit can be had and can be amplified greatly, merely by placing impedances in the propagation path.

As is well known to physicists and some of the great electrodynamicists, the choice of fundamental units used in one's model is quite arbitrary {[14]}, contrary to popular opinion. One can (and physicists do) in fact create a perfectly valid physics model using only a single fundamental variable. Jackson {71} discusses this remarkable fact as follows:

"The desirable features of a system of units in any field are convenience and clarity. For example, theoretical physicists active in relativistic quantum field theory and the theory of elementary particles find it convenient to **choose** *the universal constants such as Planck's quantum of action and the velocity of light in vacuum to be dimensionless and of* **unit magnitude**. *The resulting system of units (called 'natural' units) has only* **one** *basic unit, customarily chosen to be length. All quantities, whether length or time or force or energy, etc., are expressed in terms of this one unit and have dimensions which are powers of its dimension. There is nothing contrived or less fundamental about such a system than one involving the meter, the kilogram, and the second as basic units. It is merely a matter of convenience."*

Understanding changes of fundamental units can also lead to startling new understanding of thermodynamics. E.g., suppose we choose the joule for the single fundamental unit of a system of physics. Then length, time, mass, etc. are all functions of energy.

After Einstein, the advent of relativity, and the atomic bomb, we are comfortable with the fact that mass m is actually compressed 3-spatial energy E, given by the famous equation $E = mc^2$.

But contemplating that *time* is also highly compressed 3-spatial energy—to first order given by $E = tc^2$—seems startling to our sensibilities because of its total strangeness. But just as mass-energy can convert to 3-spatial energy via nuclear reactions, time-energy can also convert to 3-spatial energy in sharp gradient interactions. One second, converted entirely to spatial EM energy, yields approximately 9×10^{16} joules of EM energy. So even a very tiny fraction of such time-to-spatial-energy conversion can be significant.

Indeed, forefront nonequilibrium thermodynamicists are already aware of the startling fact that time itself is changed. E.g., quoting Prigogine {[15]}:

"...global behavior greatly modifies the very meaning of space and time. Much of geometry and

physics is based on a simple concept of space and time, generally associated with Euclid and Galileo. In this view, time is homogeneous. Time translations may have no effect on physical events. Similarly, space is homogeneous and isotropic; again translations and rotations cannot alter the description of the physical world. It is quite remarkable that this simple conception of space and time may be broken by the occurrence of dissipative structures. Once a dissipative structure is formed, the homogeneity of time, as well as space, may be destroyed."

In relativistic situations, the "time dilation" phenomenon due to increased velocity (or other causes such as appreciably increased energy density of the local spacetime/vacuum) increases the available 3-spatial energy while decreasing the time-energy. In short, a small amount of time-energy is converted to a relatively large amount of 3-spatial energy.

By realizing that time could be disturbed in physical processes, Nobelist Lee also got very close to that concept. He stated {[16]}:

"As we expand our observation, we extend our concepts. Thus the simple symmetries that once seemed self-evident are no longer taken for granted. Out of studies of different kinds of interactions we are learning that symmetry in nature is some complex mixture of changing plus into minus, running time backward and turning things inside out."

It seems possible to develop electrical power systems containing deliberate relativistic effects which accomplish at least a small amount of this "time to spatial energy" conversion. In sharp gradients with their momentarily highly asymmetric spacetime (and highly asymmetric vacuum energy flux), *some* time-energy conversion to 3-spatial energy does occur, but that is beyond this discussion. Far from equilibrium systems such as the MEG, which also employ repeated use of high gradients and induction of sharply asymmetrical local spacetime, do convert some time-energy to extra 3-spatial energy, but that phenomenology is still being worked out for better understanding. This is another of the Kondepudi and Prigogine "not much is understood" phenomenology involved in strong gradients {41} and the resulting violation of the Second Law of thermodynamics.

For a full accounting of the First Law, in such situations it may also be necessary to account for that time-energy that is converted to excess 3-spatial energy. Such accounting, of course, does not appear in the limited classical thermodynamics of equilibrium systems, which do not experience such effects.

This is in response to the Examiner's statement regarding the second law of thermodynamics. "The reverse (heat into physical energy, for example) cannot be fully accomplished without outside help or without an inevitable loss of energy in the form of irretrievable heat."

Response: Certainly! But any system in nonequilibrium with its active environment, and freely receiving excess potential energy from that environment, does provide the very "outside help" that the examiner himself refers to.

The examiner does not seem to realize that he merely stated that an outside energy input (which *a priori* is a condition of nonequilibrium) is required to produce negative entropy and to violate the equilibrium requirement assumed by the Second Law. The Second Law rigorously applies only to equilibrium conditions. In short, the examiner himself has stated the well-known *nonequilibrium* condition for permissibly violating the equilibrium Second Law, without realizing it. E.g., quoting a standard sophomore physics book by Serway {[17]}, in the thermodynamics section:

"The second law [of thermodynamics] does not rule out the possibility of pushing heat uphill, as it were, from a cold object to a hot one, or of creating order out of disorder. It merely states that such a reversal of the natural flow requires an influx of energy..."

Obviously any system with a net influx of energy is a nonequilibrium system!

This is easily seen by recognizing what "entropy" really means. In simplest terms, entropy is a measure of energy originally possessed by the system, whose control and use by the system has been lost. So "producing entropy" or "entropy increasing" with time passage merely means that system control of more of the energy initially available has been lost.

However, if a continuous or continual input of "additional controllable energy" is also received by the system, then the system's available, controlled energy *at any given time* need not decrease at all. That describes a *nonequilibrium steady state* system. The system continuously produces entropy and loses control of some energy, but it also continuously performs a negative entropy operation by replenishing the energy lost from its control.

If the rate of controllable energy input to the system is *greater* than the rate of entropy increase in the system, then *the available, controllable energy in the system increases steadily as time passes.* That is a system producing negative entropy, steadily and continuously. It is not forbidden at all in thermodynamics, as is pointed out from time to time, as by Serway's statement {74}, by Evans and Rondoni {46}, etc.

The use of the old equilibrium Second Law includes only those situations—arbitrarily selected—where no additional excess energy is received or allowed. Oddly, this has accounted for the "greatest problem" in thermodynamics as stated by Huw {[18]}. ???SQuoting:

"...<u>the</u> major task of an account of thermodynamic asymmetry is to explain why the universe as we find it is so far from thermodynamic equilibrium, and was even more so in the past."

Quoting Huw again {[19]}:

"A century or so ago, Ludwig Boltzmann and other physicists attempted to explain the temporal asymmetry of the second law of thermodynamics. ...the hard-won lesson of that endeavor—a lesson still commonly misunderstood—was that the real puzzle of thermodynamics is not why entropy increases with time, but why it was ever so low in the first place.

The real problem—this "greatest problem in thermodynamics"—is merely that the equilibrium Second Law only applies to a selected class of thermodynamic systems, and not to all thermodynamic systems. In violation of the Second Law, nonequilibrium systems can indeed exhibit negative entropy production. Every charge and dipole in the universe already does so {84},{85}. Since it only takes a single white crow to prove that not all crows are black, together with other proven violations of the Second Law {15},{46} destroys any absoluteness of the present statement of the Second Law. A more accurate statement has been proposed by Bearden as follows:

"First a negative entropy interaction occurs to produce some controlled energy ordering. Then that initial energy ordering will either remain the same or be progressively disordered and decontrolled by subsequent entropic interactions, unless additional negative entropy interactions occur and intervene to produce additional controlled energy ordering."

This is in response to the Examiner's statement that "By generating electricity by exploiting static energy from the magnetic flux of the permanent magnet and by the motionless generator's nature of being an open dissipative system, receiving, collecting, and dissipating energy from its

environment, i.e., from the magnetic flux stored within the permanent magnet applications' have violated the first and second law."

Response: The statement is totally false. The examiner seems unaware that any dipolarity—such as a permanent magnet—is a source of potential difference that will persist freely, so long as the dipole exists. This potential difference provides a steady flow of EM energy because *every static potential difference is identically a set of such steady state energy flows*, as shown by Whittaker {[20]} in 1903. There is no "static" potential in the sense that the examiner is interpreting it. Instead, any static potential is comprised of internal parts in continuous rapid motion. This was shown by Whittaker even before special relativity, quantum mechanics, and quantum electrodynamics were born.

If "electrostatic scalar potential" (common voltage), e.g., were truly "static", then connecting a source of static potential to a power line would not produce a dynamic flow of potential down the line. In other words, the "static" potential is not "so many joules of energy stored like mechanical ears of corn in a corncrib". Instead, the static potential is actually a steady state set of continuous EM energy flows, as proved by Whittaker {77} in 1903.

Further, any EM dipolarity exhibits the proven asymmetry of opposite charges {48},{49}. Hence the dipolarity continuously absorbs EM virtual state energy from the vacuum, integrates it, and re-emits it as a continuous flow of observable photons out at light speed.

Any "static" potential decomposes into a set of bidirectional EM flows of energy, as has been known since Whittaker's 1903 decomposition {77}.

E.g., place the electrostatic scalar potential—voltage—on the middle of a transmission line, and voltage moves out in both directions simultaneously at great speed, revealing its composite bidirectional *vector flow* composition nature. The "static energy" stored in a given dipole at any given moment, is the instantaneous time rate of flow at the moment, due to the interaction of that energy flow with the charges of the dipole (magnetic charges are known simply as "poles").

The "static" *field* from a dipole also decomposes into similar bidirectional flows, as shown by Whittaker {[21]} in 1904 in a fundamental paper which launched the entire subfield of electrodynamics known as *superpotential theory* {[22]}.

The so-called "static" magnetic field from a permanent magnet, being comprised of photons, actually has all its composite photon parts in steady motion at light speed. As pointed out by Van Flandern {[23]}, the "static" field is not "static" in the sense of a frozen waterfall, but instead it is a steady state dynamic process, analogous to a perfect but unfrozen waterfall whose composite parts are all in motion continuously.

From that continuous steady state flow of energy from any dipole—electric or magnetic—and therefore from any static potential, it is possible to "catch" as much energy as desired, in collecting pinned or fixed electric or magnetic charges, given that there are sufficient intercepting and interacting charges made available.

This is in response to the Examiner's statement that "By operating with a coefficient of performance over 3 applicants have violated at least the first law."

Response: That is a totally false statement not supported by anything appearing in thermodynamics or physics. COP > 1.0 does not violate conservation of energy, as witness the common home heat pump with $\xi < 100\%$ and COP = 3.0 to 4.0, and as witness the solar array power system, the hydroelectric power system, and the windmill—all with COP = ∞.

Here the examiner reveals he does not know the difference between the overall *thermodynamic efficiency* ξ of a system and *thermodynamic coefficient of performance (COP)*. He is unaware that COP > 1.0 electrical systems—and even COP = ∞ electrical systems—already exist and are well-known. He is unaware that, even though $\xi < 100\%$ at all times, the primary requirement for COP > 1.0 is simply that sufficient extra energy must be freely or nearly freely input to the system from the external active environment, in addition to the operator's energy input.

If the MEG had no energy input other than what the operator himself inputs and pays for, then of course it would be limited to COP < 1.0. But the MEG specifically does have another extra energy input, freely received from its active environment, which said environment is *gauge transformed* automatically by the Aharonov-Bohm effect {[24]} to contain extra active EM energy in the form of the uncurled magnetic vector potential **A**. Perturbation of that **A**-field environment then transforms its extra and free energy input to the system into very strong bursts of extra **E**-field energy inputs to the MEG, via the well-known equation $\mathbf{E} = -\,d\mathbf{A}/dt$.

In short, the *efficiency* ξ of a system may be defined as the ratio of the system's useful energy output, divided by its *total energy input from all sources*, and expressed as a percentage. The *COP* of a system may be defined as the useful energy output, divided by *only the energy that is input by the operator himself*, and expressed as a decimal number.

No system, including the MEG, has an *efficiency* of $\xi > 100\%$, because the system would have to create the excess energy from nothing and that would require violating the First Law. *[The only people who unwittingly believe that EM energy is created from nothing, and unwittingly use an EM model that assumes precisely such energy creation by every charge in the universe, are the electrical engineers and EE departments across our nation!].*

If the system's only energy input is the operator's energy input, then *numerically* the system's efficiency and its COP will be equal, except one is in percentage and the other in a decimal fraction. But for that system with only the operator's energy input, $\xi < 100\%$ and COP < 1.0, and $|\xi| = |\mathrm{COP}|$.

However, if the system also has an *additional energy input from its external environment*, then even though $\xi < 100\%$, the system's COP can permissibly be COP > 1.0 or even COP = ∞. An example of a COP > 1.0 system is the common home heat pump (which has an extra heat energy input from its environment). The typical home heat pump normally has an *efficiency* of about ξ = 50%, and thus it wastes half of all its input energy.

However, in addition to the operator's energy input, the heat pump has a second large *extra* energy input from its external environment. So the standard home heat pump nominally exhibits a COP = 3.0 to 4.0, even though ξ = 50%. In other words, even though the system is so wasteful, the heat pump has so much *extra* energy input from its environment that—even after the energy wastage by system losses—the overall system still contains and outputs three to four times as much useful energy as the *operator* has to input and pay for himself.

As examples of systems with $\xi < 100\%$ that exhibit COP = ∞, one cites the windmill, the waterwheel, the sailboat, the solar cell array power system, and a standard hydroelectric power system complete with its entire power grid and all its loads. In those systems, the operator does not furnish any primary energy input at all; instead, all the energy input comes freely from the active environment. The solar array power system, e.g., may have ξ = 20%, but still its COP = ∞ because *all the energy input is from the solar radiation environment and the operator inputs no energy at all.*

Note that the heat pump is a system far from equilibrium in its energetic exchange with its environment, freely receiving an external energy input from said environment, in addition to its power line input furnished and paid for by the operator. The MEG is a similar *nonequilibrium system.* It freely *gauge-transforms* {32},{81} its immediate spatial environment so that spatial environment now contains a curl-free magnetic vector potential **A**. Perturbation of this **A**-potential produces strong **E**-field energy pulses which are input freely to the MEG from said external **A**-vector potential environment.

Thus, like the heat pump, the MEG has an *extra* external energy input—freely input from its transformed environment. The gauge transformation of that external environment is *freely created by the nanocrystalline core's self-generation of the Aharonov-Bohm effect, without additional operator energy input.* The Aharonov-Bohm effect is indeed known to be precisely such a gauge transformation {32}. So, in addition to the energy input furnished and paid for by the operator, the MEG is a system far from equilibrium in its environment, and it also receives an extra and free EM energy input from said gauge-transformed environment.

Hence the MEG fully meets the basic criterion for a nonequilibrium system with $\xi < 100\%$ but permitted by the laws of thermodynamics to exhibit COP > 1.0. The MEG operates directly analogous to a common home heat pump, and—because of its substantial extra (and free) energy input from said active environment—it can permissibly exhibit COP > 1.0 even though its $\xi < 100\%$. No laws of physics or thermodynamics are violated, once one considers the laws of nonequilibrium systems receiving energy from their active environments.

We strongly point out that the classical electrodynamics (CED) model and the standard electrical engineering (EE) model are grossly in error and seriously obsolete, as discussed previously. For example, CED (and EE) assumes that every EM field and EM potential—along with all its joules of energy—is or has been created from its associated source charge(s). That part is correct, according to modern physics.

However, the CED model *further* assumes an inert vacuum and a flat spacetime, so in the model there cannot be any energy input from the actual environment of the "isolated" system in space. This means that the CED and EE model assumes—completely erroneously—that all EM fields and potentials and their energy have been *freely created out of nothing at all*, without any energy input at all. The model assumes the source charge receives no *observable* energy from its vacuum environment, because the CED model *does not model* the active vacuum and its energetic exchange with the system. Again, the examiner is referred to Nobelist Weinberg's clear statement of the highly energetic exchange between the vacuum's virtual particles and any source charge {42}.

This terrible implicit assumption by CED and EE—of the universal violation of the conservation of energy law (first law of thermodynamics)—has been scrubbed from all the textbooks in those fields. It is never taught to the students nor are they made aware of it. But it is still discussed in physics outside the electrical engineering department and its teaching. E.g., Sen {[25]} points it out as:

"The connection between the field and its source has always been and still is the most difficult problem in classical and quantum electrodynamics."

Kozyakov {[26]} says it even more bluntly. Quoting:

"A generally acceptable, rigorous definition of radiation has not as yet been formulated.

..."The recurring question has been: Why is it that an electric charge radiates but does not absorb light waves despite the fact that the Maxwell equations are invariant under time reversal?"

Applying the proven vacuum polarization by a charge {42} and the proven broken symmetry of opposite charges {49}, Bearden {[27]}—one of the inventors of the MEG—fully answered Kozyakov's question and solved the source charge problem in 2000. He also included it in later papers {[28]} and in the only extant technical book {[29]} dealing with the concepts and principles of extracting EM energy from the vacuum.

Objections on Page 4 of the Detailed Action:

Reconsideration of the rejection of claims 1-14 as being unpatentable under 35 U.S. C. #101 is respectfully requested. It is submitted that the examiner did not take into consideration that the the invention falls under the Aharonov-Bohm effect which is a gauge transformation of the MEG's external environment, thereby *generating* excess energy in that environment by regauging. Every charge in the universe is already an electrical generating system, because it continuously converts virtual state energy of the vacuum into real observable EM field and potential energy, continuously pouring from that charge unceasingly so long as the charge exists {80},{83},{84},{85},{98}. It follows that any system having electrical or magnetic charges, is also a set of such generators continuously outpouring real EM energy.

The macroscopic electrical power generating problem is actually to cohere and coordinate the output of these *vacuum-energy-transducing charges*. The problem is *not necessarily* to rotate a shaft in a conventional rotary generator, or dissipate chemical energy in a battery, etc. Instead, it is to arrange, control, and utilize the charges and their energy flows so that at least some of their freely flowing EM energy from the vacuum can be utilized in practical circuits. In that case, the system is deliberately transducing energy from one form to another, and that is the function cited by the examiner as comprising a generator.

We call to the attention of the examiner the **A**-potential produced by the well-known Aharonov-Bohm effect {68}. By deliberately evoking the Aharonov-Bohm effect, the MEG is producing and does produce extra EM energy, in the form of that known extra **A**-potential that appears due to gauge transformation {81}. Further, by perturbing that free **A**-potential, the MEG is transforming **A**-potential energy into **E**-field energy, via the $\mathbf{E} = -d\mathbf{A}/dt$ effect. Some of this excess **E**-field energy is then received by the MEG and output as usable extra EM energy to power loads.

The MEG therefore meets all attributes required of a generator.

Note that every electrical charge has spin, and thus has a magnetic field as well as an electric field. The two fields are orthogonal, hence the charge exhibits a Poynting energy flow $\boldsymbol{S}$ given by $\boldsymbol{S} = \boldsymbol{E}\times\boldsymbol{H}$.

The potential energy of any system can be freely changed at will, by *regauging*—primarily, regauging the equations of a Maxwellian system consists of changing one or both of the two potentials ϕ and **A**. Even electrical engineers use that fact—e.g., see Jackson {71}—to simplify the equations and make them easier to solve (and, incidentally, to also get rid of that entire class of bothersome Maxwellian systems which could exhibit COP > 1.0 or COP = ∞.).

Under the gauge freedom axiom of quantum field theory, *regauging is free*. Every electrodynamicist already accepts and uses that gauge freedom principle; e.g., see Jackson's standard book on classical electrodynamics {[30]} where he freely applies the Lorentz symmetrical regauging {[31]} {[32]} of the Maxwell-Heaviside equations, meaning that he is also freely changing the potentials

and potential energy of the Maxwellian system being modeled.

In the MEG, the evocation of the Aharonov-Bohm effect in the environment just outside the core produces an extra and free curl-free magnetic vector potential **A**. When **A** is perturbed because of the sharp rise time and sharp decay time of the operator's input pulses to the MEG, very powerful **E**-fields are produced from that external local space, and this free energy (these sharp pulses of strong **E**-field energy) impact upon and interact with every coil on the MEG core. So every coil has a dual function; in addition to its "conventional" transformer function, it also serves as an additional collector of free environmental energy being received from the active environment in the form of sharp
E-field energy pulses.

The MEG thus receives free, excess energy from its active external environment, and transforms that energy or a goodly portion of it into useful output electrical energy. Any unit receiving excess energy from its environment, and transforming that environmental input energy into useful EM energy output, meets the rigorous definition of a generator. A solar array generator, e.g., does precisely that, and so does the MEG. Hence the examiner's statement is falsified.

The examiner has not considered the free influx of <u>*additional*</u> EM energy from the MEG's active (gauge transformed) environment, so that the MEG becomes a nonequilibrium system. He has considered only an *equilibrium system* receiving no excess energy from its environment.

To the contrary from the examiner's conclusions, the MEG is in fact a *nonequilibrium system* freely receiving excess energy from its environment. It is therefore directly analogous to a home heat pump. By the laws of thermodynamics it is permitted to output more energy than the operator himself inputs and pays for. The MEG always has $\xi < 100\%$, as does a home heat pump. But it also can and does exhibit COP > 1.0, as can and does the home heat pump, because of the extra input of energy from the active environment.

This is in response to the examiner's conclusion that the device will not produce any more energy than what is already present at the input."

<u>Response:</u> The examiner's statement is false, by simple arithmetic addition. Again he erroneously assumes that the MEG is an equilibrium system, where no excess energy is received from its environment. To the contrary, the MEG is a nonequilibrium system freely receiving excess energy from its perturbed A-potential external environment. The examiner's statement is based on a false assumption and a false premise, and hence the statement itself is false.

As a simple example. Suppose the MEG operator inputs from the external power supply or power line (and pays for) —let us say—energy W_{OP}. The ($dA/dt = -E$) strongly pulsed inputs from the external uncurled magnetic vector potential environment provide an extra energy input of, say, W_{AB}, where $W_{AB} > W_{OP} > 0$. The total energy input W_T to the MEG device itself is thus $W_T = W_{OP} + W_{AB}$, and $W_T > 2\ W_{OP}$. So long as $W_{AB} > 0$, then $W_T > W_{OP}$.

It is submitted that the examiner ignored the extra environmental energy input W_{AB}, whose occurrence is already confirmed in the hard physics literature for decades. Further, that extra input is not just impinging upon the input coil of the MEG, but <u>*upon every coil wound upon the core*</u>. So every coil acquires an extra function: It receives additional **E**-field energy from the perturbed **A**-potential area outside the MEG core.

<u>*Note that the examiner's statement would in fact be true if the MEG acted only as a normal transformer*</u>

that did not gauge-transform its environment, did not invoke the Aharonov-Bohm effect to produce an extra and free A-potential energy reservoir in space outside the core, and did not receive any excess energy freely from its active gauge-transformed A-potential environment.

We also point out that violation of the Second Law is already accepted in thermodynamics for nonequilibrium systems and is proven experimentally, as previously discussed! In nonequilibrium thermodynamics, systems with sharp gradients are already known and accepted to be capable of violating the *Second Law for equilibrium systems*. E.g., see Kondepudi and Prigogine {41} for a direct statement to that effect and a list of several of these major areas that do violate the Second Law. Strong gradients are one of the areas already known and accepted to allow violation of the Second Law. Further, thermodynamically any system departure from equilibrium is certified to reduce the entropy of the system, since the equilibrium condition is the condition of maximum entropy. Every time the MEG is sharply pulsed and departs from equilibrium, it thus reduces its entropy. This means that it automatically has and receives excess energy available for control and use.

Note that the input pulses to the MEG deliberately use *sharp gradients* as the rise time and decay time of each pulse. This also produces strong gradients in the **A**-potential area outside the core that is generated by the free invoking of the Aharonov-Bohm effect. There those strong gradients constitute sharp **E**-field pulses which are inserted back into the MEG, into every coil on the core. Several other areas in nonequilibrium thermodynamics are also recognized to violate the Second Law of equilibrium thermodynamics {41}.

With regard's to the Examiner's statement regarding the large amount of power generated by the device will produce more electrical power than that available and will supply energy out when no energy is input."

Response: Nowhere do the inventors even suggest that any energy that is output is not input to the system and thus available to it! They simply state that *the environment itself furnishes excess energy in addition to that furnished by the operator from the conventional external power supply*. In that case, more energy than is available from what the operator furnishes, is actually input to the MEG—analogous to the operation of a common heat pump. So thermodynamically, a heat pump—and the MEG—can permissibly exhibit COP > 1.0, because they indeed do have more electrical power available than is available from the conventional power supply input. That means the system is in nonequilibrium, and it can output more energy than the *operator himself* inputs and pays for. There is no mystery whatsoever since the excess energy is actually input freely from the active environment. Further, it is perfectly within the laws of *nonequilibrium* thermodynamics, although it is not within the more restricted laws of *equilibrium* thermodynamics.

COP > 1.0 merely requires that more total energy is input to the system than is input by the operator alone, and that—after system losses—the *remaining* system energy is still greater than what the operator alone furnished. The required extra energy is in fact input to every coil on the MEG's core, by the bursts of strong **E**-field energy that arise in the perturbed **A**-potential environment and strike the MEG coils. Again, this is directly analogous to a standard heat pump's thermodynamics and operation.

In a system far from equilibrium with its external active environment—as is the MEG in its active

uncurled **A**-potential environment—there are *two* separate energy inputs to the system. In the MEG there is (i) the conventional energy input from the power line or other power source such as a battery, that is paid for by the operator, and there is also (ii) the *extra* **E**-field energy input from the d**A**/dt perturbed external **A**-potential environment, which is freely input from the environment and *is not paid for by the operator*.

Again, the fact that the Aharonov-Bohm effect is produced freely by the nanocrystalline core material is directly shown by a simple field measurement of the external **B**-field from the permanent magnet across the core section. With good tight contact between core and magnet, all the **B**-field of the magnet that normally exists in surrounding space is withdrawn and is localized directly inside the core. There is only a vanishingly small **B**-field in space, even right against the permanent magnet material containing the north pole or south pole of the permanent magnet itself! This conclusively proves that the **B**-field is indeed localized in the core, and therefore the Aharonov-Bohm effect is freely generated by the core material, *because it occurs even when the MEG is inoperative and not energized.*

In turn, the Aharonov-Bohm effect is well-known (e.g., around even a common toroidal coil). It is well-proven and completely accepted in physics (many thousands of papers in the physics literature). And it does produce that *extra* curl-free magnetic vector potential **A** in space outside the **B**-field localization zone. The Aharonov-Bohm effect is already known to be a free *gauge transformation* of that external spacetime itself {[33]}, which means rigorously that the potential energy density of that external spacetime has been changed. And the effect has been rigorously shown to be one mechanism that makes possible the extraction and receipt of extra EM energy from the active vacuum {90}.

Finally, the action of the MEG cannot be explained in standard electrical engineering. But it can be explained in higher group symmetry electrodynamics and in particle physics, and it has been {27},{34},{37},{81},{86},{91},{92}. The strong theoretical analysis of how extra energy in the MEG is provided from space, has been shown in two slightly differing forms of electrodynamics and published in the peer-reviewed hard physics literature {[34]},{[35]} in the second leading physics journal series in the United States. The justification of the Aharonov-Bohm effect as a means of providing energy from the vacuum—used by the MEG—has also been performed and published in the peer-reviewed hard physics literature {32},{34},{37},{92},{97}.

That this does not exist in ordinary electrical engineering is of no consequence. In fact it does exist in physics, and the proper citations of where the proof is published is sufficient.

With respect to the examiner's statement that Any additional energy "created" would violate the laws of energy conservation."

Response: Nowhere do the inventors ever imply or suggest that extra energy is or can be *created* out of nothing at all. *Only electrical engineering and electrical engineers unwittingly make such a horrendous and erroneous assumption in their standard EE model, as pointed out previously!*

If we had suggested the MEG freely creates energy from nothing, the examiner's statement would be quite appropriate and quite correct. The examiner's statement as literally written is *correct as stated*, but it has nothing to do with the operation of the MEG since the examiner's statement

erroneously implies and assumes that the only energy that is input to the MEG is the energy that the operator himself inputs.

That implied premise is false. The perturbed active A-potential environment inputs strong extra E-field energy pulses as previously described, from the well-known reaction given by $E = -dA/dt$. The MEG operates analogously as a common home heat pump, freely receiving excess energy input from its active environment, in addition to the energy input it receives that is paid for by the operator. Hence the MEG, even though having $\xi < 100\%$, is permitted by the laws of nonequilibrium thermodynamics to exhibit $COP > 1.0$, just like a common home heat pump.

When properly adjusted, the MEG can and does output more useful energy than *the energy that the operator inputs from the external power source and pays for.* But the extra energy required is indeed input freely to the MEG from the automatically regauged external active environment surrounding the MEG core. It's just that the operator doesn't have to pay for that additional energy input freely received from the external environment!

The **A**-potential created in that external space is indeed a free environmental source of energy and that is well-proven {32}. When perturbed, that free **A**-potential environment produces large **E**-field bursts of energy from the spacetime **A**-potential itself, freely. And these strong **E**-fields impinge upon and interact with every coil on the core. So every coil, in addition to its normal function, also serves as an input receiver for freely input external EM energy from the active environment. Under that circumstance, the MEG is a nonequilibrium system freely receiving excess EM energy from its active environment, in addition to the energy that the operator inputs from the external power supply. Thermodynamically the MEG is a nonequilibrium system, receiving excess energy from its environment. *It is thus permitted to output more EM energy than the operator alone inputs, because of the extra energy input from the environment.*

With respect to the statement that "Any additional energy "created" would violate the laws of energy conservation."

Response: The statement as made is quite true, since *the energy conservation law prohibits creation of any energy.* In no fashion have the inventors ever claimed to be creating energy. However, the truth of the examiner's statement as literally given, does not prohibit extra *energy transfer* freely into a nonequilibrium system from its active environment with said active environment acting as a second energy reservoir and source.

The inventors never claim anywhere that energy is freely created out of nothing by the MEG—*again, only the standard seriously flawed classical U(1) electrical engineering electrodynamics model, electrical engineers, and electrical engineering textbooks assume such a preposterous notion!* Instead, the inventors state (and show) that the MEG—due to special action of its nanocrystalline core material—freely produces the Aharonov-Bohm effect by a *free gauge transformation of the space outside the core localization zone.* The Aharonov-Bohm effect is in fact already known to be such a gauge transformation {32}.

We point out again the gauge freedom axiom of quantum field theory—*regauging is perfectly work-free*, and that is already accepted by all electrodynamicists and gauge physicists on earth. Electrical engineers use it, often without an explicit statement of the work-free aspect {1}. But with the external space outside the MEG's core *regauged*, that regauged zone now freely

contains additional active **A**-potential energy. When perturbed, that **A**-potential energy reservoir freely generates powerful **E**-field energy pulses freely, which impinge back upon the MEG and provide additional real EM energy inputs to every coil wound on the MEG core.

Input of excess energy from an active environment has nothing at all to do with purported creation of energy out of nothing—else windmills, solar cell array power systems, waterwheels, kites, sailboats, gliders, and hydroelectric power systems would be impossible. So the hidden implied premise of the examiner—that the inventors are claiming "creation of energy from nothing"—is totally false. In producing COP > 1.0, the MEG is no more creating energy than is the heat pump with COP > 1.0—or is the windmill, sailboat, waterwheel, solar array electrical generating system, or hydroelectric power system with COP = ∞.

For the rest of the statement, our invention has nothing at all to do with any other invention. It has to do with evoking the Aharonov-Bohm effect and conveniently using that known and proven (and widely accepted) effect to provide an extra environmental energy reservoir "for free". In turn, when freely perturbed, this extra, external energy reservoir freely furnishes an *extra* **E**-field energy input to the MEG, so that *the MEG receives and has available more energy than the operator alone furnishes from its conventional external power supply.*

With sufficient extra **E**-field energy input from the free external reservoir, even with its normal losses the MEG can legitimately output more energy than the operator has to furnish—precisely analogous to a heat pump's capability and operation. The MEG is permitted to do so, since extra energy input was and is freely received from the active environment (precisely like a home heat pump receives excess energy in the form of heat energy from the external environment).

With respect to the drawing it is earnestly submitted that the drawings show an operable system—as described in the specification and amplified in these responses—when the extra energy input from the gauge transformed vacuum and its extra **A**-potential are accounted. The system then is a nonequilibrium system freely receiving excess energy from its active external environment, and using that extra energy to do more work than the energy input by the operator only.

The efficiency ξ of the MEG is always $\xi < 100\%$, and some of the total input energy (by the operator and by the environment) is wasted. However, the remainder after the losses is still greater than the energy input by the operator only. So not only is the MEG an operable system both experimentally and theoretically, but it is also permitted to exhibit COP > 1.0 by the standard thermodynamics of a nonequilibrium system, as previously discussed in some detail with cited references. It is thermodynamically permitted to exhibit COP = ∞, with use of clamped positive feedback and meeting Kron's criterion {109} as discussed.

With respect to the statement that "...when the input power source (e.g., 38) is taken away, the remaining circuit becomes inoperable."

This is not the case since the difference between a $1.0 < COP < \infty$ nonequilibrium system—such as a home heat pump with efficiency ξ of about 50% and yet with COP = 3.0 to 4.0—and a COP =

∞ nonequilibrium system such as a solar array powered system with loads and with efficiency of, say, 17% but with COP = ∞.

A deliberately inoperable "cut-off" or "switched off" COP > 1.0 or COP = ∞ system is still a valuable and operable COP > 1.0 or COP = ∞ system! One does not get rid of a home heat pump, merely because the system has an on/off switch and becomes inoperable when the power supply energy furnished by the operator is cut off by throwing the switch! The cutoff switch does exactly what the examiner is objecting to: It disconnects the external power supply from the open-loop heat pump. Cutting the power back on again by simply flipping the switch, results in resuming the operation of the system.

One also does not get rid of a COP = ∞ windmill-driven generator and power system, merely because the system is cut off and inoperable when the blades are rotated parallel to the wind and windmilling stops.

Similarly, removing the power supply from the open-loop (1.0 < COP < ∞) MEG is "cutting off" the switch, and so the MEG in its open-loop 1.0 < COP < ∞ form ceases operation. Connecting the power supply again will result in the MEG resuming its operation as described in this write-up.

For cutting off the MEG in its COP = ∞ configuration, other means are employed which simply "open the clamped feedback loop input to the operator's input section". In that manner, the fundamental input is cut off, and the system stops operating. Saying that an operational system that can be cut on and cut off is an "inoperable system" is inappropriate.

Patent Examiner states: "Further, all figures referring to a coefficient of performance, receiving more power that was put in, etc., are inoperable as violating at least the first and second laws of thermodynamics."

Response: The statement is mangled and totally confused. COP > 1.0 system do not receive more power than was put in, when the total input of both the operator and the external environment are included. The MEG does not ever receive more power than was put in by all its system inputs, which would be quite impossible since it would requires receiving power that it created from nothing! But for the MEG, as for the heat pump and any other COP > 1.0 nonequilibrium system, one must consider *two energy inputs*, not just the one in the examiner's mind. These two energy inputs are (a) the energy input from the external commercial electrical power source, which the operator must pay for, and (b) the extra *free* energy input from the gauge-transformed external environment of the core, due to the invoking of the Aharonov-Bohm effect that produces a free external **A**-potential reservoir of energy via said gauge transformation {32}. The latter **A**-potential environmental reservoir—when perturbed—furnishes an extra **E**-field energy input to every MEG coil. This extra energy input from the environment is not paid for by the operator, but is for free.

So just like a home heat pump, the open-loop MEG receives energy paid for by the operator, and it also receives extra energy freely input from its active environment that is not paid for by the

operator. Hence—precisely analogous to the home heat pump—the MEG is a nonequilibrium system freely receiving extra energy from its environment. It therefore is permitted by the laws of standard nonequilibrium systems to exhibit
COP > 1.0, even though its overall system efficiency is always $\xi < 100\%$.

The statement by the examiner that such operation violates the first and second law is false. Else the common home heat pump would be impossible since it already demonstrates just such operation. We stress again that nowhere do the respondents ever claim or state that the MEG outputs more energy than is totally input! They do state that the MEG outputs (permissibly!) *more energy than the input energy that the operator himself inputs and pays for*. That is because the additional energy is indeed input, but by the active environment, not by the operator. And that has nothing at all to do with violating the first and second laws of thermodynamics. Simply refer to any standard nonequilibrium thermodynamics textbook or reference, and to any textbook on the common home heat pump.

This application is indeed directed toward generation, as previously explained in some detail. Considering the MEG as a simple transformer described by standard electrical engineering, is totally in error. Interpreting the nonequilibrium MEG's COP > 1.0 performance as depending on a distorted notion of perpetual motion and creation of energy from nothing is a logical non sequitur, as previously shown in detail.

It is believed that the examiner has illogically applied simple electrical engineering and an equilibrium thermodynamics interpretation for his assessment of the MEG. He has ignored the MEG's deliberate use of broken symmetry physics and gauge transformation physics, and also did not apply nonequilibrium thermodynamics—which is necessary for a proper description and assessment of the MEG—and of any other electrical power system freely taking excess energy from the vacuum and curved spacetime.

As clearly explained previously in some detail, *the MEG is not a standard transformer*, because it performs additional special functions that no other known transformer performs. Specifically, the MEG

(i) freely *gauge-transforms* the immediate external environment outside the core material, to form an asymmetrical polarized vacuum and curved spacetime there {97};

(ii) thereby evokes the well-known Aharonov-Bohm effect {34} {97}, so that the asymmetrical vacuum outside the core is freely filled with extra **A**-potential energy {27},{28}. In physics that specific function is well-known and experimentally proven beyond question as the Aharonov-Bohm effect {27},{28}; but said effect does not even exist in the classical Maxwell-Heaviside electrodynamics model or in electrical power engineering;

(iii)uses sharp gradients in the operator's input from the external power supply, thereby

also freely producing sharp gradients in the surrounding curl-free magnetic vector potential **A**; sharp gradients are recognized by thermodynamicists as areas violating the Second Law of equilibrium thermodynamics {41};

(iv) thus *freely* produces very strong, extra **E**-field input pulses arising directly in and from said perturbed external vacuum environment, whereupon these strong **E**-fields from the surrounding space freely impinge upon every coil wound upon the transformer core, making it also an input coil receiving excess energy from the active environment. Note that this meets the generator function (cited by the examiner) of transforming energy from one form—the **A**-potential energy in the environmental transformation area—into **E**-field energy then introduced into the MEG coils, and

(v) thus converts every coil on the core to a dual function not used in normal transformers, where each coil also receives an additional strongly pulsed **E**-field energy input from the environment in addition to its magnetic flux input through the core;

(vi) by adjusting the phasing of the extra and free pulsed **E**-field energy inputs to the various coils, said inputs and the resulting mutual field reactions between multiple coils mostly produce *in-phase* and additive extra EM energy output from the output coils;

(vii) by additively or mostly additively receiving these additional input **E**-field pulses directly from its activated asymmetrical vacuum environment, freely, the MEG receives real, usable EM energy (in strongly pulsed **E**-field form) that has been extracted from the local external vacuum by the *free* gauge transformation {[36]} of said external vacuum in space outside the core. It also involves the transformation of the **A**-potential energy available in the gauge transformed space outside the core, into **E**-field energy. Again, no other known transformer performs such a function to evoke a free availability of **A**-potential energy in the external environment, then transduces that energy into **E**-field energy in order to provide extra, usable EM energy (**E**-field energy) from the asymmetrical vacuum;

(viii) by having an extra, free energy input from its active external vacuum environment, *thermodynamically* the MEG rigorously becomes a nonequilibrium system directly analogous to the common home heat pump in its operation. Thus

(ix) even though the overall MEG efficiency ξ remains at $\xi < 100\%$ and the MEG does have normal internal losses, it still is permitted to output more energy than the *operator himself* inputs and pays for—which condition rigorously constitutes COP > 1.0. The energy for the extra output is freely input by said active and gauge-transformed vacuum environment outside the core. Again, no other known transformer performs such a function, nor acts as a *nonequilibrium system* freely

receiving excess EM energy from its *gauge-transformed* active vacuum environment. So

(x) by the laws of nonequilibrium thermodynamics, the equilibrium second law of thermodynamics can be and is permissibly violated, and the MEG can and does permissibly exhibit COP > 1.0, precisely analogous to the thermodynamic operation of a common home heat pump as previously explained; and

(xi) thermodynamically, by using clamped, governed positive feedback of a portion of the MEG's output energy, back to the operator's input section, and where said feedback energy equals the operator's normal input (Kron's criterion) {109}, then the external power source can be disconnected and the MEG is permitted to operate in COP = ∞ closed-loop mode, powering itself and its load by extracting the necessary energy from the active vacuum environment.

In view of the foregoing, it is believed this application is in condition for allowance and the allowance thereof is respectfully requested.

Respectively submitted,
PATRICK et al

By _____
Norman Friedland
Attorney of Record
(Reg. No. 20,070)

Norman Friedland
The Towers
11300 U.S. Highway One
Suite 400
North Palm Beach, FL 33408
(561) 626-4111
Date: May 14, 2004